

# Bioenergy: A sustainable solution to landscape degradation

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## Abstract

Forest and landscapes provide innumerable ecosystem benefits. These ecosystem benefits are threatened by global land degradation which is made worse by global climate crisis and population explosion. Bioenergy as a renewable source of energy offer solutions to manage and restore a significant portion of degraded landscape, ameliorate global warming while providing food and energy security. This paper explores current trends and case studies covering the benefits of biofuels and biochar and their role in landscape restoration.

Research shows that bioenergy crops reduce land degradation. Biofuel the yield product, mitigates carbon emissions and contributes to renewable energy demand. Furthermore, Biochar, one of its byproducts enhances soil fertility, improves crop productivity, contributes to the filtration of wastewater and benefit food security. Opportunity exists in peri-urban, urban and forest landscape to contribute to bioenergy availability with respect to biomass feedstock. The potential negative effects that may result from its use and production such as land-use change, and land use intensification can be reduced through appropriate land zoning.

In general, these renewable products are still relatively underexplored and underutilized especially in developing country context. Apart from the environmental benefits bioenergy offers opportunity for socioeconomic growth and development since energy power these growths. It is concluded that biomass technology must be encouraged, promoted, invested, implemented, and demonstrated across landscapes.

It is recommended that choice of appropriate raw material and efficient technology for bioenergy as well as other bioproducts production is of immense importance in order to produce high quality product with reduced environmental impact. Also, to maximize the benefits of bioenergy and bioproducts, there is need for policies and incentives that encourage their proper utilization and minimizes negative effect that may arise.

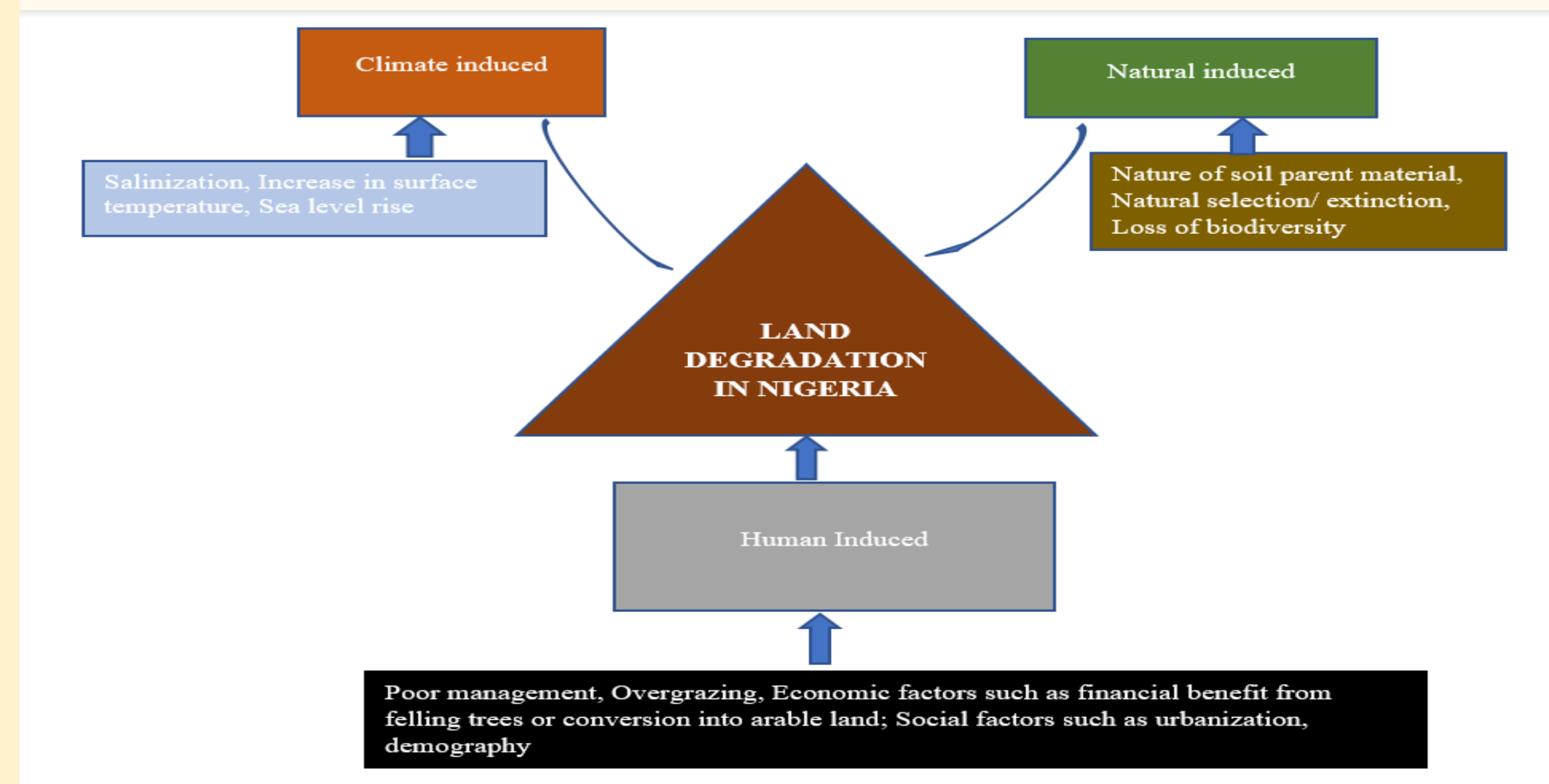


Fig1: Interacting factors causing landscape degradation in Nigeria

## Scope and Main objectives

Nigeria, West Africa currently have a total forest cover of about 10%. This can be attributed to several natural and anthropogenic factors. Deforestation is one of the major factors driving loss of tree cover. Deforestation eventually leads to landscape degradation. A number to landscape restoration goals have been documented by Land Degradation Neutrality target Setting Program by UNCCD in partnership with the government of Nigeria and other multilateral organizations to target Land degradation. This include;

- Improve land productivity and soil organic carbon stocks (SOC) in 463,300 hectares of cropland and grasslands by 2030 as compared to 2015
- Rehabilitate 1,722,660 ha of cropland showing declining land productivity and 10,565,040 ha of cropland showing early signs of declining land productivity by 2030
- Halt the conversion of forests and wetlands to other land cover classes by 2020
- Increase forest cover by 20% by 2030 as compared to 2015
- Reduce the rate of soil sealing (conversion to artificial land cover) by 40% by 2030 as compared to 2015

Bioenergy, a renewable source of energy produced from biomass, have the potential to contribute to landscape restoration goals in Nigeria. The goal of the paper is to asses' current trends and case studies covering the benefits of biofuels, biogas and biochar and their role in landscape restoration and explore their potential in contributing to land restoration in Nigeria.

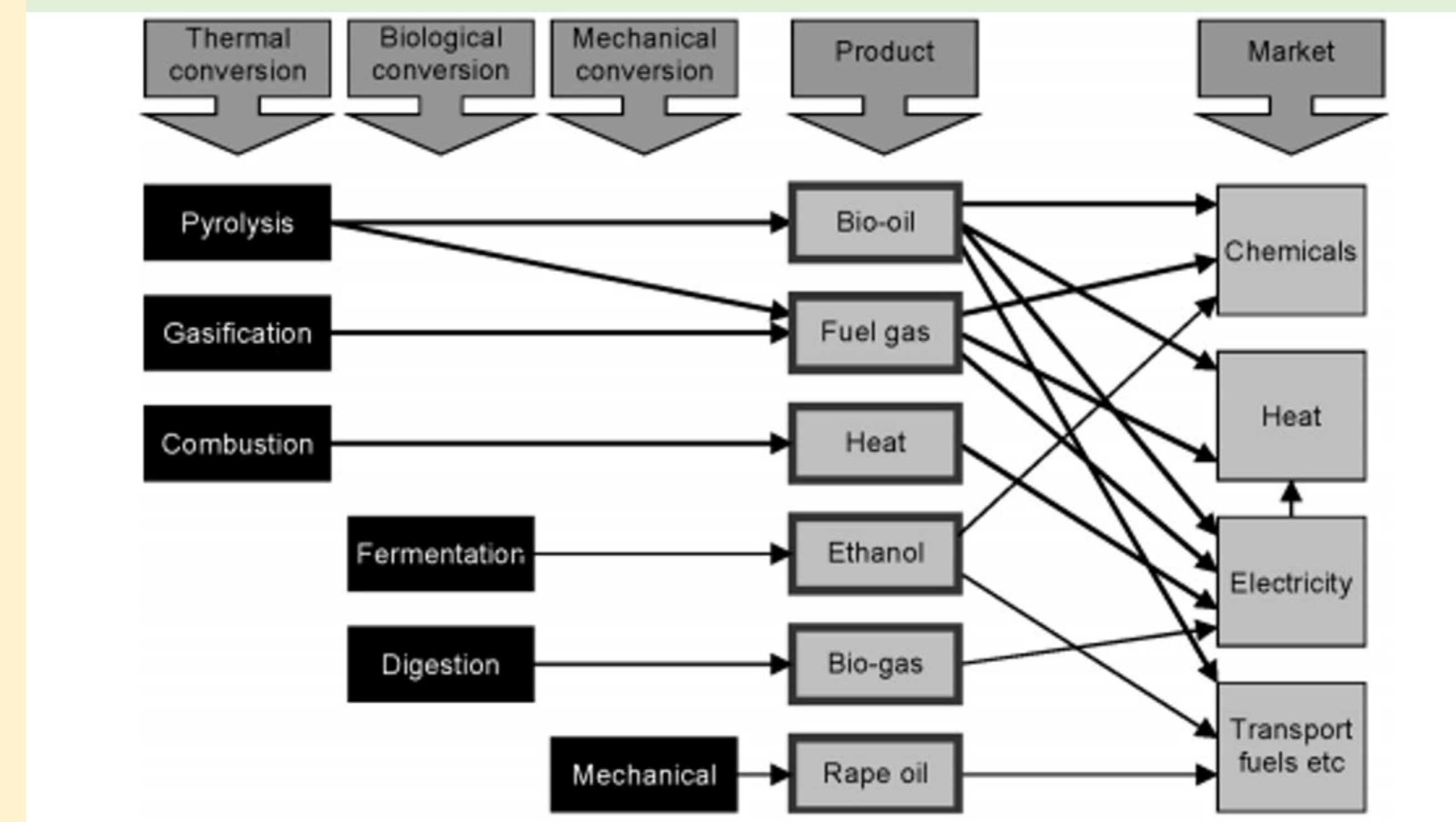
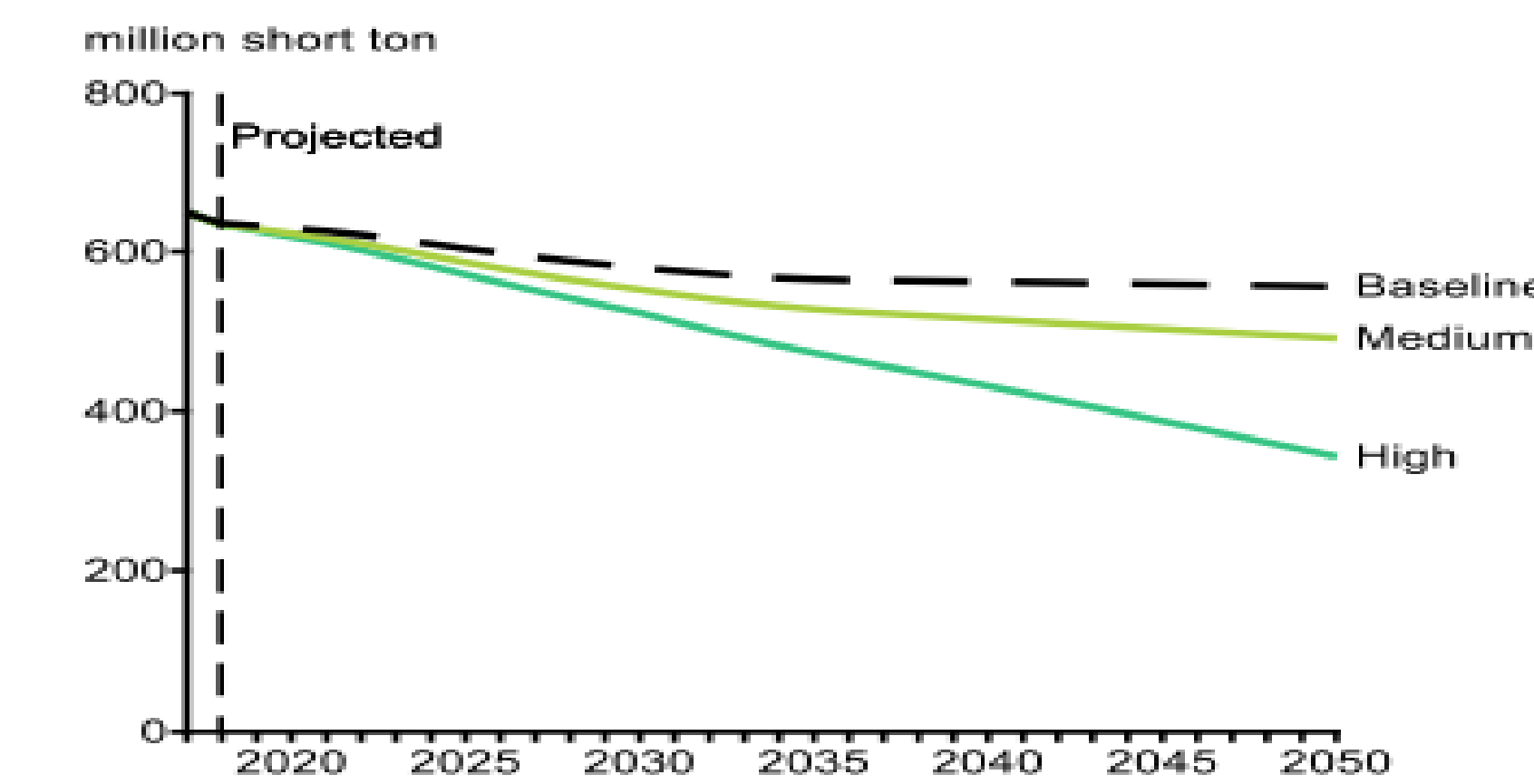


Fig 2: Production of Bioenergy and Bioproducts

## Innovative Approach



Credit: MBG&J

Fig 3: Projected GHG Emissions under Modeled Scenario

Biochar, a solid fuel residue of the process of pyrolysis and gasification.

- Reduce soil acidity/raise pH and aluminum toxicity.(Berihun *et al.*, 2017) and thus improveland productivity
- By improving moisture retention biochar may reduce the demand for irrigation and make cropping more secure.
- Increase soil microbial biomass. And support other beneficial organism like earthworms
- Enhance CO2 sequestration thereby mitigating emissions (Oladele and Adekunle, 2021)
- Support nitrogen fixation(Mia *et al.*, 2014)

Biofuel, a product from conversion of biomass

- The Biodiesel can contribute significantly to GHG reduction and indirectly to landscape restoration (Reid *et al.*, 2021)
- The use of ethanol for transportation, and for other industrial purpose
- Heat produced through combustion can be used for electricity

Biogas like Syngas as a sources of cooking oil will reduce dependence on charcoal and fuelwood in Nigeria and contribute to trees and forest conservation

Other bio-products like bio-oil, bio-chemical are sustainable form of household income thereby reducing reliance on forest product and boosting economic growth

## Conclusions and Recommendation

- Bioenergy technology must be encouraged, promoted, invested, implemented, and demonstrated across Nigeria landscapes in other to scale up various landscape restoration efforts.
- There are, however, lots of concerns that it may exacerbate the problem of deforestation particularly in naturally and socially delicate landscape of Nigeria.
- However, it is pertinent to understand that wood source is only about 30% of the potential sources of bioenergy feed stock, other sources will make more contribution.
- Needless to say, the influence of biochar varies strongly according to the types of feedstock/soil
- Nigeria has a large portion of waste product in its urban, suburban and rural area, making the potential for bioenergy very high.
- There is need for policies and incentives that encourage their proper utilization and minimizes negative effect that may arise altogether

## References

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